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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/444,689	11/22/1999	BABACK MOGHADDAM	MERL-1255	8972

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PATENT DEPARTMENT
MITSUBISHI ELECTRIC INFORMATION
TECHNOLOGY CENTER AMERICA INC
201 BROADWAY
CAMBRIDGE, MA 02139

EXAMINER	
LAROSE, COLIN M	
ART UNIT	PAPER NUMBER
2623	

DATE MAILED: 12/30/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/444,689	MOGHADDAM ET AL.	
	Examiner	Art Unit	
	Colin M. LaRose	2623	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 November 2002* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-12* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-12* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Arguments and Amendments

1. Applicants' arguments and/or amendments filed 11 November 2002, have been entered and made of record. Claims 6-12 have been added. Claims 1-12 are pending.

Response to Amendments and Arguments

2. Applicant's arguments have been fully considered but they are not persuasive for at least the following reasons.

Applicant argues (page 3, Paper 6) that Osuna is unrelated because Osuna's system detects rather than classifies. However, Osuna does classify – he classifies objects into two classes (face and non-face) using hyperplanes created by an SVM, as illustrated in figure 1. Throughout his paper, Osuna uses the terms "classifier" and "classification" repeatedly in reference to his system. The Introduction section states:

"... problems such as object detection or image classification have received an increasing amount of attention ..."

"In this paper we concentrate on the Support Vector Machine (SVM), a pattern classification algorithm recently developed ..."

"... we used SVM as the core classification algorithm in a face detection system ..."

The last quote suggests that classification is an integral part of detection, rather than being "totally unrelated" as Applicant asserts.

Applicant states (page 5, Paper 6) using SVMs has not been applied to gender classification because "it is an unlikely choice" and goes against conventional wisdom, and (page

8, Paper 6) "the insight behind the invention lies in the realization that SVMs ... *can* be used for gender classification." Osuna states "face detection (i.e. classifying objects in an image as face or non-face) is interesting because it is an example of a natural and challenging problem for demonstrating and testing the potentials of Support Vector Machines" (page 133, column 2, paragraph 6). This suggests that Osuna chose to classify faces and non-faces simply for demonstrative purposes.

Continuing with the same paragraph in Osuna:

"There are many other object classes and phenomena in the real world that share similar characteristics, for example, tumor anomalies in MRI scans, structure defects in manufactured parts, etc. A successful and general methodology for finding faces using SVM's should generalize well for other spatially well-defined pattern and feature detection problems."

The above teaching provides the motivation to apply SVMs for classifying any "object classes and phenomena in the real world that share similar characteristics." Male faces are real-world phenomena that share similar characteristics; female faces are real-world phenomena that share similar characteristics; male and female faces form two mutually exclusive object classes.

Although Osuna does not contemplate classifying by gender using SVMs, one skilled in art would have been motivated to implement a gender classifier with Osuna's system since males and females are well-known "object classes in the real world that share similar characteristics" and Gutta shows that attempting to classify faces by gender using a trained classifier is a well-known and "interesting" endeavor.

Applicant states (page 6, Paper 6) "the claimed invention uses training images that only include faces," however, claim 1, as claimed, does not exclude the use of non-face training images. Even if claim 1 did specify that only face images are used as training images, this feature is taught by Gutta (see Abstract).

Applicant argues (page 10, Paper 6) that the Moghaddam '833 reference is "irrelevant." However, this reference is clearly not irrelevant because it "is useful in the detection and recognition of virtually any multifeatured entity such as human faces" (see Abstract), in accordance with Osuna's teachings.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claim 9 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Regarding claim 9, the original specification does not appear to disclose the training images are "non-linear, homogeneous and symmetric images." Applicant is requested to show support for the above features in the specification.

Claim Rejections - 35 USC § 103

5. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

6. Claims 1-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osuna and Gutta.

Regarding claim 1, Osuna discloses a method for classifying objects in images as face or non-face, comprising the steps of:

supplying a vector support machine with a plurality of training images, including images of faces (page 134, column 1, section 3.2: a database of face and non-face images is used to train an SVM);

determining a plurality of support vectors from the training images for identifying a hyperplane (page 130-131, section 1.1: support vectors are extracted from a data set of labeled examples; "the support vectors are the data points that lie at the border [of the hyperplane] between the two classes" (page 131, first paragraph));

supplying the support vector machine with a test image (page 134-135, section 3.2.1: system is tested using two sets of images);

classifying the test image with respect to the hyperplane (page 134, column 2, under "4.": "classify the pattern using the SVM" and Table 2, page 135).

Osuna is silent to using his SVM classification system for classifying faces by gender.

Gutta discloses a hybrid classifier system that classifies images of faces based on gender using trained learning systems. Gutta's system performs similar to that of Osuna: a training set is used to train the system, and then test images are applied and classified.

It would have been obvious to one of ordinary skill in the art at the time of the invention to employ Osuna's system for classifying images of faces according to gender, since determining the gender of a person is one of the basic identifying features of a person, and Gutta teaches that a trainable learning system can be used to classify face images by gender. In addition, Osuna suggests that his classification system can be utilized to classify any "object classes in the real world that share similar characteristics."

Regarding claim 4, Osuna is silent to reducing the resolution of the training images and the test image by sub-sampling before supplying the images to the support vector machine.

Gutta discloses normalizing training and test images by reducing the resolution before supplying the images to a training system (page 1356, section 5, first paragraph: images at 256 x 384 are reduced to 64 x 72. Pages 1356-1357, section 5, second paragraph: 2000 images are divided into two sets -- 1900 and 100; then 100 of the 1900 are used for training, and the 1800 others are used for testing). Gutta is silent to reducing the resolution by sub-sampling, however using sub-sampling to reduce the resolution of an image was conventional and well-known to those of ordinary skill in the art at the time the invention was made. Official notice taken.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Osuna by Gutta in order to reduce the size of testing and training images, since doing so reduces memory requirements and reduces training time.

Regarding claim 5, Osuna discloses maximizing a distance between the support vectors and error margins of the hyperplane (page 130, section 1.1, second paragraph: "Intuitively, a good choice is the hyperplane that leaves the maximum margin between the two classes," and also figure 1).

Regarding claim 6, Osuna discloses using test images that are 19 x 19 = 361 pixels (section 3.2, page 134). These 19 x 19 test images are substantially close to Applicant's disclosed low resolution "thumbnail" images, which are 21 x 12 = 252 pixels, in contrast to the disclosed high resolution images, which are 80 x 40 = 3,200 pixels (page 11, specification). The exact sizes and dimensions of the test images are considered to be arbitrary design parameters since no unexpected results are produced by using a 21 x 12 test image as opposed to a 19 x 19 test image.

Regarding claim 7, Osuna discloses forming a non-linear hyperplane (figure 6 and page 131, column 1: "Since it is unlikely that any real life problem can actually be solved by a linear classifier, the technique has to be extended in order to allow for non-linear decision surfaces").

Regarding claim 8, Osuna discloses having a 2.9% classification error for a test run (table 2, page 135).

Regarding claim 9, Gutta discloses using 2000 faces as training images (see Abstract). Facial are inherently comprised of non-linear features, all of the training images are faces, therefore, the images are homogeneous, and at low resolutions, faces are substantially symmetric in appearance.

Regarding claim 10, Osuna discloses determining the non-linear hyperplane using a non-linear projection function (page 131, column 1: "projecting the original set of variables x in a

higher dimensional feature space ... the solution will have the form *[non-linear projection function]*, and therefore will be non-linear").

Regarding claim 11, Osuna discloses a Gaussian RBF as a projection function (page 131, column 1). The function takes the form $K(x,x_i) = \exp(-\|x - x_i\|^2)$, which is employed to minimize the expected test error between x and x_i.

Regarding claim 12, Osuna discloses using a quadratic classifier (table 1, page 131: classifier $K(x,x_i) = (x^T x_i + 1)^d$, which is quadratic for $d = 2$.

7. Claims 2 and 3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Osuna and Gutta as applied to claim 1, and further in view of Moghaddam.

Regarding claim 2, Gutta discloses passing training images to a face detection and normalization system that detects faces and scales the images to a reduced resolution (page 1356, section 5, first paragraph). However, the scaling is not performed in order to locate the faces.

Also, Gutta and Osuna are silent to warping scaled images to locate facial features.

Moghaddam discloses a method for recognizing faces and facial features in images. Moghaddam discloses scaling an input image to a number of levels (column 10, lines 41-44), and from the scaled images, finding a window that has the highest probability of containing a face (column 11, lines 1-4). Moghaddam then discloses warping the detected face to be spatially aligned with that of the training set so that features of the face may be easily recognized (column 11, lines 10-14).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Osuna and Gutta by Moghaddam in order to achieve the claimed invention, since

preprocessing of the training images by scaling and warping effects normalization of the training images, which facilitates the training process by placing all input images in a similar format. [See also figure 1 of "SexNet" by Golomb et al. wherein images are preprocessed by scaling and warping in order to align and normalize the faces so that features may be easy to locate.]

Regarding claim 3, Osuna and Gutta are silent to masking the scaled images to reduce the amount of hair.

Moghaddam discloses masking the scaled image to "include only an interior of the face" so that only "the most salient facial components" are present (column 11, lines 15-18).

It would have been obvious to one of ordinary skill in the art at the time of the invention to further modify Osuna and Gutta by Moghaddam to mask the scaled images to reduce the amount of hair by including only the interior of the face, since hair (on the head) is not a facial feature and is therefore immaterial to determining the gender of a face.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37

CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colin M. LaRose whose telephone number is (703) 306-3489. The examiner can normally be reached Monday through Thursday from 8:00 to 5:30. The examiner can also be reached on alternate Fridays.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amelia Au, can be reached on (703) 308-6604. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9314.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the TC 2600 Customer Service Office whose telephone number is (703) 306-0377.

AMELIA M. AU
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600

CML
Group Art Unit 2623
16 December 2002